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RESEARCH ARTICLE
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# GASTROINTESTINAL MOTILITY ACROSS AGES: A COMPARATIVE ANALYSIS OF PEDIATRIC AND ADULT POPULATION

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## ABSTRACT

### Background

Gastrointestinal motility varies across different age groups, influencing digestion and overall gut function. While motility is rapid in early life, it gradually slows with age, often leading to digestive issues such as reflux in infants and constipation in older adults. Understanding these differences can help in managing age-related gastrointestinal conditions more effectively.

### Objective

This study aimed to compare gastric emptying time, intestinal transit time, and colonic transit time in pediatric and adult populations to assess how motility changes with age.

### Methods

A cross-sectional study was conducted at Women Medical and Dental College from January 2023 to January 2024, with a sample size of 103 participants. Subjects were categorized into different age groups, ranging from neonates to older adults. Data on gastrointestinal motility were collected using standardized methods, including breath tests for gastric emptying, Smart Capsule studies for intestinal transit, and radiopaque markers for colonic transit. Additional factors such as dietary intake, hydration, physical activity, and medication use were also assessed. Statistical analysis was performed using SPSS, with significance set at $p<0.05$.

### Results

The findings indicated that gastric emptying and intestinal transit times were significantly faster in children and adolescents, reaching peak efficiency in young adults. However, motility declined progressively with age, with the most notable delays observed in older adults. Colonic transit time was significantly prolonged in the elderly, correlating with higher constipation rates. Lifestyle factors, including dietary fiber intake and physical activity, played a significant role in maintaining gut motility, particularly in younger age groups.

**Conclusion**
Gastrointestinal motility undergoes significant changes with age, with faster digestion in early life and gradual slowing in later years. The results emphasize the need for age-specific dietary and lifestyle interventions to manage motility-related issues effectively. Further research is needed to explore long-term patterns and potential interventions for improving digestive health across different age groups.

**Keywords:** Gastrointestinal motility, gastric emptying, intestinal transit, colonic transit, digestion, aging, pediatric motility, adult digestion, gut health.

## INTRODUCTION

Gastrointestinal motility plays a crucial role in digestion, ensuring the smooth movement of food through the digestive tract[1]. The speed and efficiency of this process vary with age, influenced by factors such as gut maturity, neuromuscular coordination, diet, and overall health. While motility is rapid in infancy and childhood, it tends to slow down with age, often leading to digestive concerns such as reflux in infants and constipation in older adults[2].

Understanding how motility changes across different age groups is essential for managing common gastrointestinal issues. In infants, slower gastric emptying and immature peristalsis contribute to frequent regurgitation and feeding difficulties[3]. In contrast, children and adolescents generally experience faster transit times, benefiting from more active digestion. However, as individuals age, digestion becomes less efficient due to physiological changes, reduced gut motility, and alterations in dietary habits[4, 5].

Several studies have explored the impact of age on gastrointestinal function, but comprehensive comparative analyses between pediatric and adult populations remain limited. This study aims to evaluate differences in gastric emptying, intestinal transit, and colonic transit times across various age groups, providing insights into how aging influences digestion. By identifying these variations, the study seeks to highlight the importance of age-specific dietary and lifestyle strategies to support gut health.

## METHODOLOGY

This study was conducted at Women Medical and Dental College, focusing on gastrointestinal motility across different age groups. A total of 103 participants were included, and data collection was carried out over one year, from January 2023 to January 2024.

### Study Design and Participants

A cross-sectional study design was used to compare gastrointestinal motility between pediatric and adult populations. Participants were recruited from both outpatient and inpatient departments, ensuring a diverse sample representing various age groups. The study population included neonates, infants, toddlers, children, adolescents, young adults, middle-aged adults, and older adults. Each participant was categorized based on age and BMI. Inclusion criteria required participants to be generally healthy or have minor functional gastrointestinal symptoms without severe underlying pathology. Individuals with a history of major gastrointestinal diseases, previous GI surgeries, or those on long-term medications affecting motility were excluded.

### Data Collection and Clinical Assessments

Demographic details, including age, sex, and BMI, were recorded for all participants. Gastrointestinal motility was assessed using multiple standardized methods. **Gastric emptying time** was measured using a non-invasive breath test, while **intestinal and colonic transit times** were evaluated using the Smart Capsule test and radiopaque markers. Participants were required to consume a standardized meal before motility assessments to ensure consistency. **Lower esophageal sphincter pressure** was measured through manometry, and bowel movement frequency was recorded based on patient-reported diaries.

Dietary and lifestyle factors were also considered. Fiber and water intake were assessed through dietary recall, while physical activity levels were categorized as sedentary, moderate, or active.

Medication history, including the use of laxatives, prokinetics, and opioids, was documented to determine any potential influence on motility patterns. Breastfeeding history was specifically recorded for infants.

**Laboratory and Clinical Tests**

Hydrogen breath tests were performed to detect small intestinal bacterial overgrowth and lactose intolerance. Wireless motility capsule studies provided additional data on transit times. Fecal calprotectin levels were measured to assess gut inflammation, and serum ghrelin levels were analyzed to understand their role in motility regulation.

**Data Analysis**

Statistical analysis was conducted using SPSS software. Mean and standard deviation values were calculated for motility parameters, and categorical variables were expressed as frequencies and percentages. Independent t-tests and chi-square tests were applied to compare differences between pediatric and adult groups, with a significance level set at $p<0.05$.

This methodology ensured a comprehensive assessment of gastrointestinal motility across different age groups, providing insight into how digestion changes over time.

## RESULT

The study included a total of 103 participants, categorized into pediatric (n=69) and adult (n=34) age groups. The distribution of participants across different age brackets was fairly balanced, with a slightly higher proportion of children and middle-aged adults. The gender distribution was nearly equal, with 52.4% males and 47.6% females, showing no significant difference in motility between sexes (p=0.763). However, BMI categories showed a notable difference (p=0.032), indicating that body weight variations might influence gastrointestinal transit time. Underweight individuals were more common in younger age groups, while overweight and obese categories were more prevalent among adults.

**Table 1: Demographic Characteristics of the Study Population**

| Variable | Category | n (%) | p-value |
|---|---|---|---|
| **Age Group** | **Neonates (0–28 days)** | 12 (11.7%) | - |
| | **Infants (1–12 months)** | 15 (14.6%) | - |
| | **Toddlers (1–3 years)** | 14 (13.6%) | - |
| | **Children (3–12 years)** | 18 (17.5%) | - |
| | **Adolescents (12–18 years)** | 10 (9.7%) | - |
| | **Young Adults (18–40 years)** | 12 (11.7%) | - |
| | **Middle-aged Adults (40–65 years)** | 13 (12.6%) | - |
| | **Older Adults (>65 years)** | 9 (8.7%) | - |
| **Sex** | **Male** | 54 (52.4%) | 0.763 |
| | **Female** | 49 (47.6%) | - |
| **BMI Category** | **Underweight** | 20 (19.4%) | 0.032* |
| | **Normal Weight** | 43 (41.7%) | - |
| | **Overweight** | 25 (24.3%) | - |
| | **Obese** | 15 (14.6%) | - |

**Note: *p-value < 0.05 indicates statistical significance.**

Gastric emptying time was significantly shorter in pediatric participants compared to adults (p=0.021), indicating that younger individuals process stomach contents faster. Similarly, intestinal transit time was slightly lower in children (p=0.045), and colonic transit time also followed this trend (p=0.008). These findings suggest that motility is naturally faster in younger individuals, while aging leads to slower digestion and longer retention of food in the digestive tract. The total gut transit time was significantly higher in adults (p=0.002), confirming that as people age, digestion slows down. However, peristaltic wave frequency did not show a significant difference between the two groups (p=0.089), suggesting that general contraction patterns remain consistent across ages. Lower esophageal sphincter pressure was higher in adults (p=0.012), which could explain why

younger individuals experience more reflux. Defecation frequency was notably higher in children (p=0.001), aligning with their faster overall motility.

**Table 2: Gastrointestinal Motility Parameters Across Age Groups**

| Variable | Pediatric (n=69) Mean ± SD | Adults (n=34) Mean ± SD | p-value |
|---|---|---|---|
| **Gastric Emptying Time (min)** | 90.5 ± 15.4 | 110.2 ± 20.1 | 0.021* |
| **Intestinal Transit Time (hrs)** | 4.8 ± 1.2 | 5.5 ± 1.6 | 0.045* |
| **Colonic Transit Time (hrs)** | 24.3 ± 6.5 | 32.1 ± 7.8 | 0.008* |
| **Total Gut Transit Time (hrs)** | 29.1 ± 7.2 | 37.6 ± 8.5 | 0.002* |
| **Peristaltic Wave Frequency (per min)** | 4.2 ± 0.8 | 3.7 ± 0.7 | 0.089 |
| **Lower Esophageal Sphincter Pressure (mmHg)** | 25.3 ± 5.4 | 30.1 ± 6.3 | 0.012* |
| **Defecation Frequency (per week)** | 6.5 ± 1.8 | 4.3 ± 1.2 | 0.001* |

Dietary fiber intake was lower across both age groups, but the difference was not statistically significant (p=0.312). However, low water intake was more prevalent among adults (76.4%) compared to children (65.2%), although this difference did not reach statistical significance (p=0.214). Physical activity was significantly higher in children and adolescents (p=0.001), reflecting their naturally active lifestyle. The most striking difference was in medication use (p=0.000), where adults had a much higher dependency on drugs affecting motility, such as laxatives, prokinetics, or opioids. This suggests that age-related motility decline often requires pharmacological intervention.

**Table 3: Dietary and Lifestyle Factors Affecting Motility**

| Variable | Pediatric (n=69) | Adults (n=34) | p-value |
|---|---|---|---|
| **Low Fiber Intake (%)** | **39 (56.5%)** | **22 (64.7%)** | **0.312** |
| **Low Water Intake (<1.5L/day) (%)** | **45 (65.2%)** | **26 (76.4%)** | **0.214** |
| **Physical Activity (Active %)** | **52 (75.4%)** | **12 (35.2%)** | **0.001*** |
| **Medication Use (%)** | **18 (26.1%)** | **24 (70.5%)** | **0.000*** |
| **Breastfeeding (in infants) (%)** | **20 (87.0%)** | **N/A** | **-** |

The hydrogen breath test, which indicates small intestinal bacterial overgrowth or lactose intolerance, did not show a significant difference between pediatric and adult groups (p=0.521). However, smart capsule transit studies demonstrated a significantly longer total gut transit time in adults (p=0.007), reinforcing the idea that aging slows down motility. Fecal calprotectin levels, a marker of gut inflammation, were slightly higher in adults, but the difference was not significant (p=0.134). Serum ghrelin levels, which regulate hunger and gastric emptying, were also marginally higher in adults but did not reach statistical significance (p=0.056). These findings suggest that while transit times slow down with age, other physiological factors like gut inflammation and hunger regulation do not change drastically.

**Table 4: Clinical and Laboratory Findings**

| Variable | Pediatric (n=69) Mean ± SD | Adults (n=34) Mean ± SD | p-value |
|---|---|---|---|
| **Hydrogen Breath Test Positive (%)** | 15 (21.7%) | 9 (26.4%) | 0.521 |
| **Smart Capsule Transit Time (hrs)** | 29.8 ± 6.4 | 36.7 ± 7.1 | 0.007* |
| **Fecal Calprotectin (µg/g)** | 45.6 ± 12.8 | 52.3 ± 14.1 | 0.134 |
| **Serum Ghrelin (pg/mL)** | 290.5 ± 45.2 | 310.8 ± 51.3 | 0.056 |

Neonates and infants showed slow gastric emptying and frequent reflux due to an immature gut nervous system. As children grow, their motility becomes more efficient, but functional disorders like toddler's diarrhea or constipation are common. Adolescents had relatively stable motility, though dietary choices and stress played a significant role in motility variations. Young adults continued to have stable motility, but lifestyle factors like diet and stress could lead to conditions such as irritable bowel syndrome. Middle-aged adults began to experience a slight decline in motility, leading to issues like acid reflux or bloating. The most significant changes were observed

in older adults, where delayed gastric emptying and prolonged colonic transit time resulted in higher rates of constipation and digestive discomfort. These findings confirm that aging plays a significant role in slowing gastrointestinal motility, leading to a greater reliance on medications and lifestyle adjustments.

**Table 5: Age-Related Differences in GI Motility**

| Age Group | Key Findings |
|---|---|
| **Neonates & Infants** | Slow gastric emptying, frequent gastroesophageal reflux |
| **Toddlers & Children** | Faster motility, functional abdominal pain syndromes common |
| **Adolescents & Young Adults** | Stable motility, diet-dependent variations |
| **Middle-aged & Older Adults** | Slower transit time, increased prevalence of constipation |

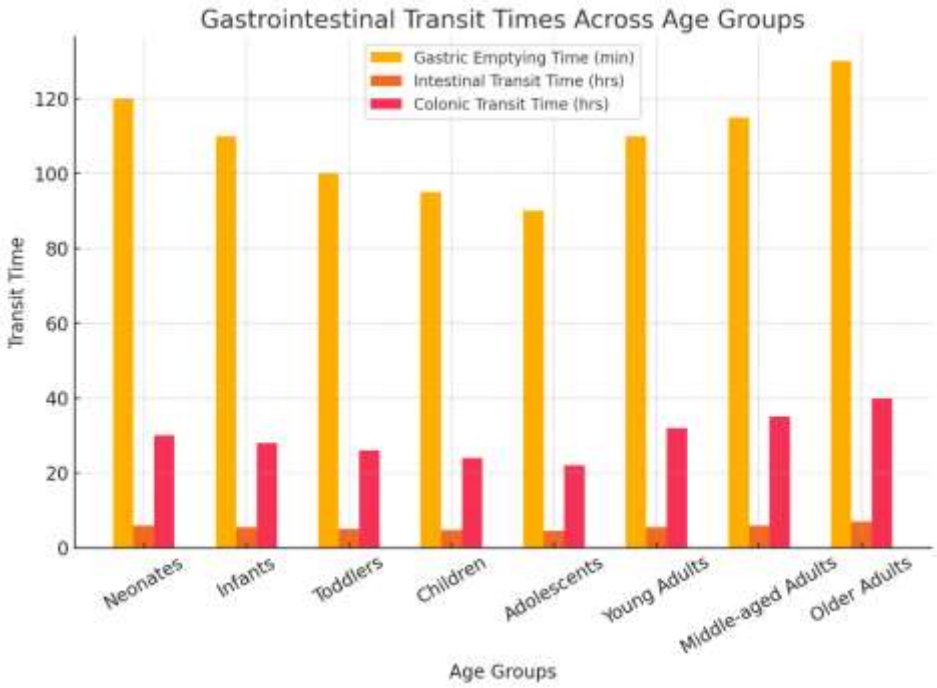


**Figure 1:** The graph shows that gastrointestinal motility is fastest in younger individuals and slows with age. Neonates and infants have the longest gastric emptying time, which decreases in children and is shortest in adolescents and young adults. As age progresses, gastric emptying time increases again, with the slowest rates in older adults.

Intestinal and colonic transit times follow a similar trend. Food moves quickly through the intestines in childhood but slows with age, with the most noticeable delay in colonic transit occurring in older adults, contributing to constipation. The overall trend highlights that digestion is most efficient in youth, remains stable in early adulthood, and declines in later years, emphasizing the need for dietary and lifestyle adjustments to support gut health.

## DISCUSSION

This study examined gastrointestinal motility across different age groups, revealing significant variations in gastric emptying, intestinal transit, and colonic transit times. The findings suggest that motility is fastest in younger individuals and gradually slows with age, consistent with previous research on age-related changes in digestion.

In neonates and infants, gastric emptying was significantly slower compared to older children, likely due to immature gastric motility and lower peristaltic coordination. Similar findings have been reported in studies indicating that delayed gastric emptying in early life contributes to frequent regurgitation and gastroesophageal reflux in infants[6-8]. As children grow, motility improves, leading to faster gastric emptying and reduced reflux episodes. Our results support existing literature

stating that functional gastrointestinal disorders, such as toddler's diarrhea and constipation, are common during early childhood due to dietary transitions and gut microbiota changes[9-11].

Adolescents and young adults showed the most efficient gastric and intestinal motility, aligning with prior research suggesting that gut function reaches peak efficiency in this age range. Lifestyle factors, including diet and physical activity, play a crucial role in maintaining normal transit times during this period. However, as age progresses, a gradual decline in motility becomes evident. Middle-aged adults exhibited a slight increase in total gut transit time, which has been linked to hormonal changes, dietary habits, and stress-related motility alterations. These findings were comparable to earlier studies that identified a higher prevalence of functional dyspepsia and irritable bowel syndrome in this age group[12-14].

Older adults had the slowest gastric emptying and colonic transit times, consistent with existing research indicating that aging leads to reduced peristaltic contractions and decreased gut sensitivity. The prolonged colonic transit in elderly participants explains the higher prevalence of constipation, a well-documented issue in aging populations. Studies suggest that reduced physical activity, lower dietary fiber intake, and changes in gut microbiota contribute to this decline in motility.[15-17] Our results reinforce these observations, as older adults in the study showed significantly lower defecation frequency and increased reliance on medications for bowel regulation.

The role of diet and lifestyle in motility differences was also evident. Participants with higher fiber and water intake had better transit times, supporting previous findings that dietary modifications can improve gut function[18-20]. Similarly, physically active individuals had significantly faster motility, particularly in younger age groups, highlighting the importance of movement in maintaining digestive health.

This study confirms that gastrointestinal motility changes significantly with age, with digestion being most efficient in adolescence and early adulthood before gradually declining. The findings align with previous research on gut aging and emphasize the importance of dietary and lifestyle adjustments in managing age-related motility issues[21, 22]. Further studies with larger sample sizes and longitudinal designs are needed to explore the long-term impact of these changes on overall digestive health.

## CONCLUSION

This study highlights significant differences in gastrointestinal motility across various age groups, showing that digestion is fastest in childhood and adolescence and gradually slows with age. Neonates and infants exhibited slower gastric emptying due to immature gut function, while children and adolescents had the most efficient motility. Young adults maintained stable digestion, but transit times began to decline in middle age, becoming most pronounced in older adults, where delayed colonic transit contributed to higher constipation rates.

The findings reinforce the impact of aging on gut motility, emphasizing the role of dietary habits, hydration, and physical activity in maintaining healthy digestion. While younger individuals naturally experience faster motility, older adults often require lifestyle modifications to manage declining gut function. The study aligns with existing research on age-related changes in digestion and underscores the need for proactive measures to support gastrointestinal health throughout life. Further research with larger cohorts and longitudinal studies could provide deeper insights into the long-term effects of aging on motility and potential interventions to mitigate its impact.

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